XaCCT 3.0

Software Requirements Specification

For The

Gatherer

Identification GATHERER-SRS

Revision 1.0

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31 Lechi St., Bnei-Brak, 51200, Israel, Tel: 972-3-618-1118, Fax: 972-3-578-4121

Signatures

	Name	Title	Signature	Date
Written By:	Tal Givoly	SW Team Leader		20/7/97
Checked By:	Yuval Tal	SW Team Leader		20/7/97
Approved By:	Limor Schweitzer	V. President		20/7/97

Changes

Revision	Date	Name	Description

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1. GENERAL

1.1. SCOPE

This document describes the software requirements of the Gatherer. The Gatherer is a major component in the XaCCT 3.0 system.

1.2. APPLICABLE DOCUMENTS

[1] System Specification Document for the XaCCT 3.0 System, XACCT-SSD, Revision 1.0.

[2] Gatherer-CEM Interface Description Document, Gatherer-CEM-IDD, Revision 1.0.

[3] Software Requirements Specification for the Central Event Manager, CEM-SRS, Revision 1.0.

[4] Gatherer-Gatherer Interface Description Document, Gatherer-IDD, Revision 1.0.

In any case of discrepancy between any of the above documents and this document, this document will take precedence.

1.3. SYSTEM OVERVIEW

The Gatherer is responsible for gathering information from one or more Information Sources (IS). The gatherer configures the different ISs according to information sent from the CEM. At specific times, the Gatherer sends network information in UNIRs to the CEM to be stored (and, possibly, merged with other UNIRs) in the CDB.

The Gatherer relies on Information Source Modules (ISMs) to access the IS, and is, thus, designed to be completely independent of the particular ISs it interfaces. The Gatherer is responsible to upgrade load and run ISMs without interference to the rest of the Gatherers capabilities or other ISs.

The Gatherer is designed to be a lightweight process that may be run on non-dedicated computers as a background task (not consuming considerable CPU, memory, disk space or network resources). Under other circumstances, the Gatherer may be run on a dedicated computer, or be allowed to utilize more computer and network resources. The parameters that determine the amount of resources consumed are determined via control of the CEM.

There are two distinct behaviors an ISM may have. An ISM may behave as an Synchronous ISM (SISM) or Asynchronous ISM (AISM). An ISM may concurrently

exhibit both behaviors and be considered both an SISM and an AISM. An AISM is a source of information that may asynchronously (randomly, without synchronization with any other event) produce UNIRs that represent some sort of network event including some auxiliary information regarding this event. An SISM does not generate events, but is rather requested to handle some request for some information, it handles the request synchronously (the caller waits for the reply) and returns a reply.

To summarize, the Gatherer's functionality includes:

1. To access ISs in order to collect network information (either synchronously or asynchronously).
2. Performing enhancement of UNIRs.
3. Monitoring state of ISs connected to the Gatherer.
4. Routing UNIRs from one Gatherer to another.
5. Being controllable by the CEM completely (start/stop/configuration etc.).
6. Buffering outgoing traffic.
7. Maintaining a cache of information obtained from ISs or other Gatherers.
8. Maintaining an LMS (Local Module Storage) of ISMs (Information Source Modules).
9. Downloading ISMs from CEM on demand.
10. Automatically upgrading Gatherer SW from CEM when a newer version is available at CEM.
11. Allowing for encryption of all communication links within the system (communication between Gatherer and CEM and between Gatherers).

1.4. System Use Cases

Listed below is a list of CEM use-cases. The details of each use-case are discussed in "**4.** Use Cases".

1. Startup.
2. Shutdown.
3. Error occurs.
4. Install/Remove/Configure an IS.
5. Handle CEM request to set/get properties of Gatherer/IS.
6. Receive network event from AISM.
7. Receive request for information from SISM.
8. Route a message to another Gatherer.
9. Enhance a UNIR received from another Gatherer.
10. Synchronize Clocks.

1.5. System Major Objects

This section lists the major analysis-objects identified by the use cases discussed in "**4.** Use Cases".

1. *Gatherer* - The core of the Gatherer that loads and runs ISMs and enhances and routes UNIRs. A Gatherer communicates with other Gatherers to perform to

route UNIRs for further processing, or to request information from SISMs connected to the other Gatherers.

2. *CEM* - The Central Event Manager that controls the Gatherer's operation and eventually collects all data collected by the Gatherer.
3. *Cache* - The cache is used to store recent network information collected from SISMs to be checked before accessing a local (connected to the same Gatherer) or remote (connected to another Gatherer) SISM. The cache is of a limited and remotely configurable size.
4. *ISM* - The ISM communicates with the Information Source that it manages and with its container Gatherer. The IS Module is not part of the Gatherer installation but is transferred dynamically from the CEM. The reason for that is that the upgrade of the IS should be simple and in a single, central place. The IS Module communicates with its managed IS in the following forms:
   a) Ethernet.
   b) UDP/IP.
   c) TCP/IP.
   d) SNMP.
   e) Telnet.
   f) File access.
   g) ODBC.
   h) Native API.

   The ISM may behave either as an AISM, an SISM or both.
5. *LMS* - The Gatherer stores ISMs in a Local Module Storage of a configurable size.
6. *Output Buffer* - All network information to be sent to other entities in the system (CEM or Gatherers), is stored in this buffer. The buffer is maintained in memory and its size is configurable from CEM.
7. *Log File* - All errors are recorded into this log file. The log file is cyclic and may be accessed remotely by the CEM..
8. *UNIR* - Unified Network Information Record are produced and processed in many ways by the Gatherer.
9. *Route* - Computational flows of information indicating what to do with each incoming request, whether to enhance it, and how, and to whom to send it (another Gatherer or CEM)..
10. *ISCM* - The Gatherer relays information transparently between an ISM and its configuration module, the ISCM.
11. *Configuration* - The Gatherer configuration includes the following types of configuration parameters:
    a) Gatherer parameters (Output Buffer size, Cache size, LMS size, maximum CPU/network usage, time synchronization intervals).
    b) ISM parameters (AISM and/or SISM behavior, ID of ISM, IS-specific parameters specifying how to access IS).

c) Enhancement/Routing parameters (detailed instructions on how to handle incoming traffic from Gatherers and AISMs connected to the Gatherer, what to do with them and to whom to forward them).

1.6. System Non-Functional Requirements

1.6.1. Hardware & Software Requirements

The Gatherer shall be able to run (in different binary versions) on the following hardware platforms:

- Sun Sparc running Solaris 2.5.
- Intel-based PC with a Pentium or Pentium Pro processor running either Windows NT 4.0 or Windows 95.

In any case, a TCP/IP stack must be properly installed.

1.6.2. Performance Requirements

The critical issue with regards to performance is keeping up the pace imposed by handling the incoming data and requests in time to receive new ones without spilling the output buffer. The performance depends, therefore on the influx and the computer's speed.

Nonetheless, the computer resources shall be carefully monitored and shall not exceed a configurable parameter.

1.6.3. Security Requirements

The Gatherer may be exposed to security risks in its communication and configuration. All communications between Gatherers and between the Gatherer and the CEM shall be designed to be encrypted and digitally signed in the future. The local storage of the Gatherer shall not contain any confidential information. Administration of the Gatherer is performed remotely by the CEM and imposes security requirements of the CEM.

2. EXTERNAL INTERFACES

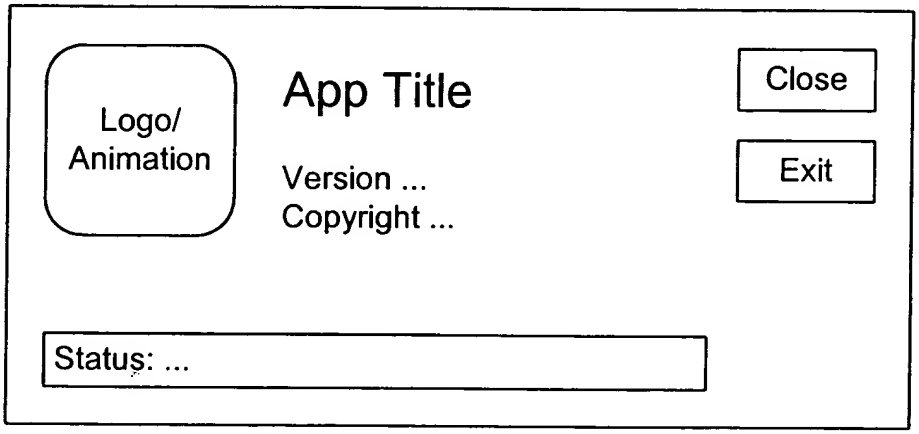
2.1. GATHERER-CEM INTERFACE

This interface is described completely in [2].

3. USER INTERFACE

The Gatherer has a very limited user interface. All its configuration is set through the CUI, besides initial parameters set during installation.

The Gatherer initially runs as a minimized fixed-size window. This window allows viewing of the product name, version, logo (possibly animated), and status, and contains two buttons. One button minimizes the window, and the other is used to terminate the application. Below is a schematic of this window:



Clicking "Close" minimizes the window. Clicking "Exit" displays a confirmation dialog, confirming shuts down the application, otherwise, the dialog is removed. The dialog is modal, but both the window and the dialog are non-blocking (all application activity continues).

During installation, the following parameters are set by the user:
1. The Port of the Gatherer.
2. The IP and Port of the CEM to which this Gatherer connects to.
3. The directory in which to install the Gatherer (all Gatherer components will be placed within this directory or its sub-directories).

These parameters can be changed only by reinstalling the software.

The software can be removed (shared components - used by other applications, will be removed only if not referenced).

Below are the Gatherer items that are remotely configurable (the defaults themselves are not maintained at the Gatherer, but rather defaults used by CEM/CUI as default values for the configuration purposes):

1. Output buffer size (default 100 KB).
2. Cache Size (default 1 MB).

3. LMS size (default 1 MB).
4. Maximum CPU percentage, network usage percentage or BW (set individually, default 10% for all).
5. Time synchronization interval & moving average length (default 30 minutes and 90 minutes respectively).
6. Log size (default 256 KB).
7. Route/Enhancement parameters - details are at design level.
8. IS parameters (for each ISM) - details are at design level.

4. USE CASES

4.1. STARTUP

Overview/Purpose

To start the Gatherer's operation after proper or improper shutdown (failure).

The Gatherer initially "knows" only the IP (implicitly) and the Port on which it is running and the IP and Port of the CEM. Upon startup, It sends and message to initialize communication with the CEM including the version of the Gatherer SW itself. If this SW is old, the CEM will instruct the Gatherer to upgrade its SW version. The CEM will then set the Gatherer's configuration, including which ISs are accessed by the Gatherer, using which ISMs (type and version), and using which parameters. If the Gatherer does not have the ISM of the correct version in its LMS, it will request that ISM from the CEM. The Gatherer also receives from the CEM the configuration of the enhancement/route handled by the Gatherer. The last point at which collection took place is also negotiated (possibly with CEM assistant) - TBD. After all Gatherer-related settings are configured, all operations are started.

Actor/Stimulus

OS loader or user manually (after shutdown).

Frequency

Medium - once every system startup/shutdown or failure.

Alternative Courses

None.

Interaction Diagram

See in [1].

4.2. SHUTDOWN

Overview/Purpose

To stop running on the computer and to allow proper termination of connections.

Actor/Stimulus

The user, the OS or an exception handler.

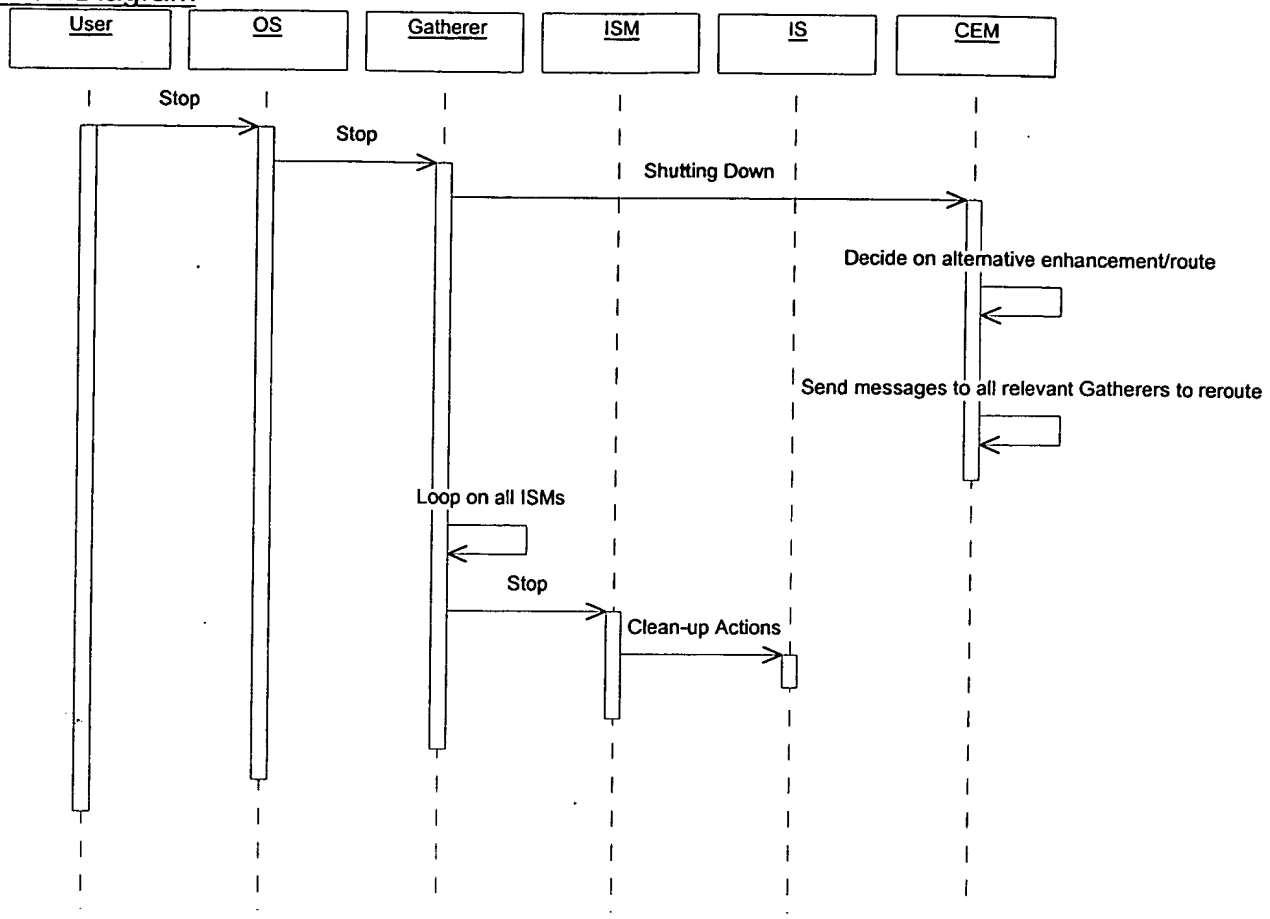
Frequency

Low - once every system startup/shutdown or failure.

Alternative Courses

The stimulus may change and this may distinguish between a full shutdown and an expedited procedure. In case of failure, a short procedure will shutdown ASAP recording the circumstances to the log.

Interaction Diagram



4.3. Error Occurs

Overview/Purpose

To handle error conditions in an orderly fashion, and to, possibly, convey this information to the CEM.

Actor/Stimulus

Any problem condition within Gatherer or with respect to Gatherer's external interfaces.

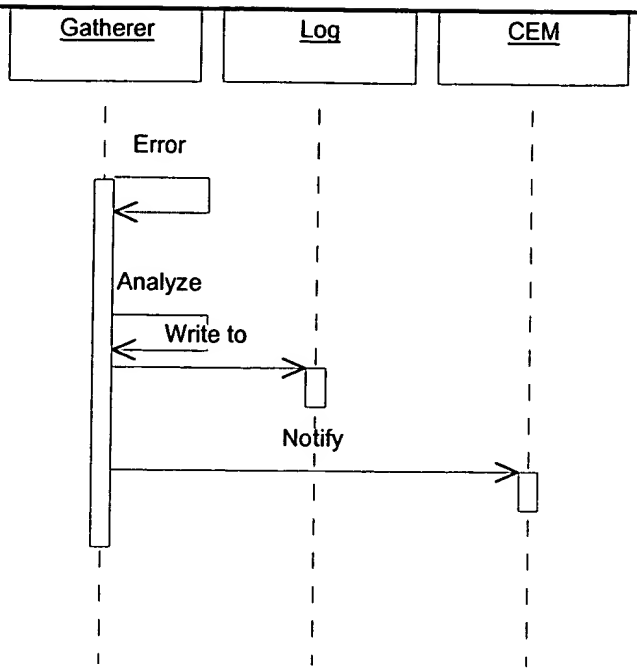
Frequency

Low - hopefully, errors do not occur often.

Alternative Courses

None.

Interaction Diagram



4.4. INSTALL/REMOVE/CONFIGURE AN IS

Overview/Purpose

The user may choose to install, remove or reconfigure ISs.

Actor/Stimulus

User via CUI and CEM or CEM under special circumstances.

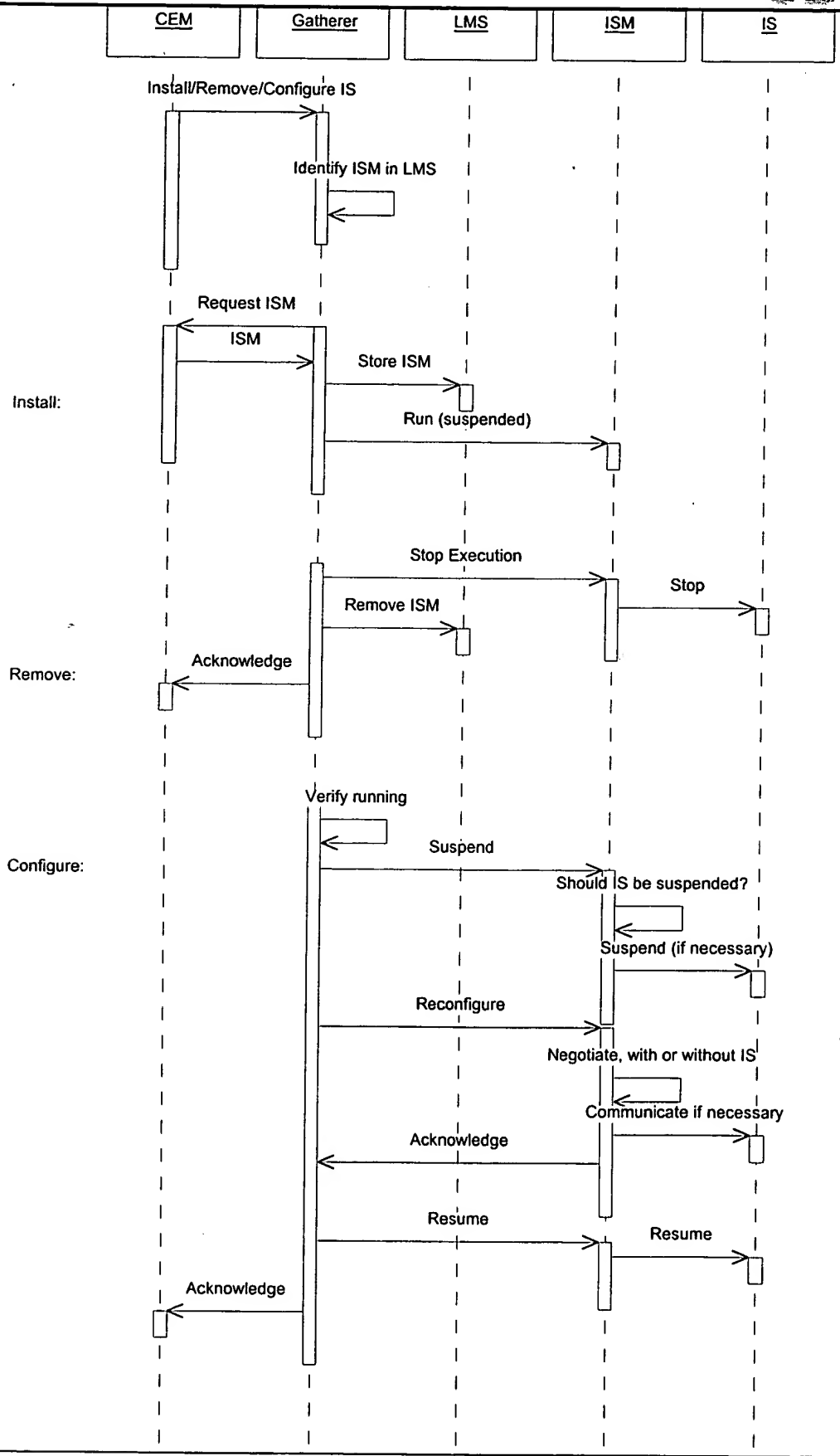
Frequency

Low - IS configuration is relatively static.

Alternative Courses

Installing, removing and configuring are similar, but distinct courses.

Interaction Diagram


CEM
Gatherer
LMS
ISM
IS
Install/Remove/Configure IS
Identify ISM in LMS
Request ISM
ISM
Store ISM
Install:
Run (suspended)
Stop Execution
Stop
Remove ISM
Remove:
Acknowledge
Verify running
Suspend
Configure:
Should IS be suspended?
Suspend (if necessary)
Reconfigure
Negotiate, with or without IS
Communicate if necessary
Acknowledge
Resume
Resume
Acknowledge

4.5. HANDLE CEM REQUEST TO SET/GET PROPERTIES OF GATHERER/IS

Overview/Purpose

The CEM may request to set or get various Gatherer/IS parameters.

Actor/Stimulus

Request from CEM.

Frequency

Low - this is likely to occur during reconfiguration, startup/shutdown, errors, etc.

Alternative Courses

None.

Interaction Diagram

A slight modification on "**4.4.** Install/Remove/Configure an IS".

4.6. RECEIVE NETWORK EVENT FROM AN AISM

Overview/Purpose

AISMs may originate a network event. The Gatherer is configured (by the CEM) to expect this and take specific actions in response. These involve enhancing the information using SISMs or routing the whole enhanced network event to another Gatherer or to the CEM after all enhancements are complete. In all cases an SISM is accessed, the Cache is first checked to contain the information.

Every access to an SISM has a time-out and if it exceeded, both the Gatherer awaiting the response and the SISM discontinue attempt to resolve the request.

Actor/Stimulus

Any network event that is detected at an ISM configured to act as an AISM.

Frequency

Very High - up to every packet traversing a link will cause this use-case.

Alternative Courses

A remote SISM may be accessed for enhancing the information. In this case, the local Cache is first checked, if the requested enhancement is not found, a remote Gatherer is requested to supply the information (the remote Gatherer is connected locally to the SISM that can supply the response).

Interaction Diagram

The following pseudo-code describes the actions taken by the Gatherer upon receipt of UNIR from an AISM.

Receive UNIR from AISM

while should be enhanced
    if enhancement cached

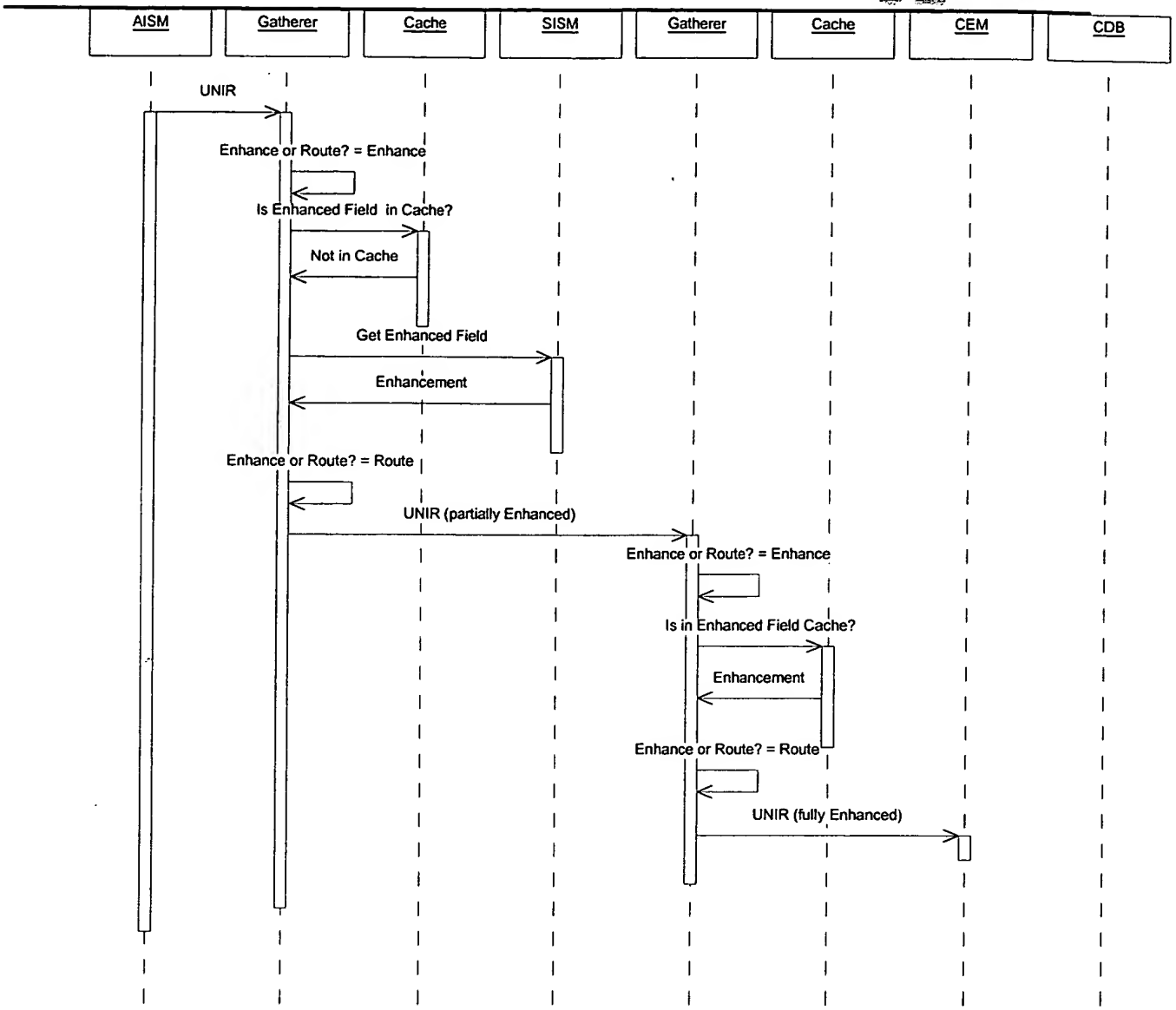
```
                retrieve from cache
                enhance

        else if enhancement local
                call local SISM for enhancement
                if not timed out
                        enhance
                else
                        do not enhance

        else    // enhancement from SISM at remote Gatherer
                call remote SISM for enhancement
                if not timed out
                        enhance
                else
                        do not enhance

if should be routed
        send UNIR (partially enhanced) to target Gatherer
else
        send UNIR (fully enhanced) to CEM
```

This is also described schematically in the following interaction diagram:



4.7. RECEIVE REQUEST FOR INFORMATION FROM SISM

Overview/Purpose

A remote Gatherer needs to get information from a Gatherer, and it makes sense to: a) Cache this information at the requesting end; b) Not pass the whole UNIR containing large amounts of data through this Gatherer.

Actor/Stimulus

Remote Gatherer request.

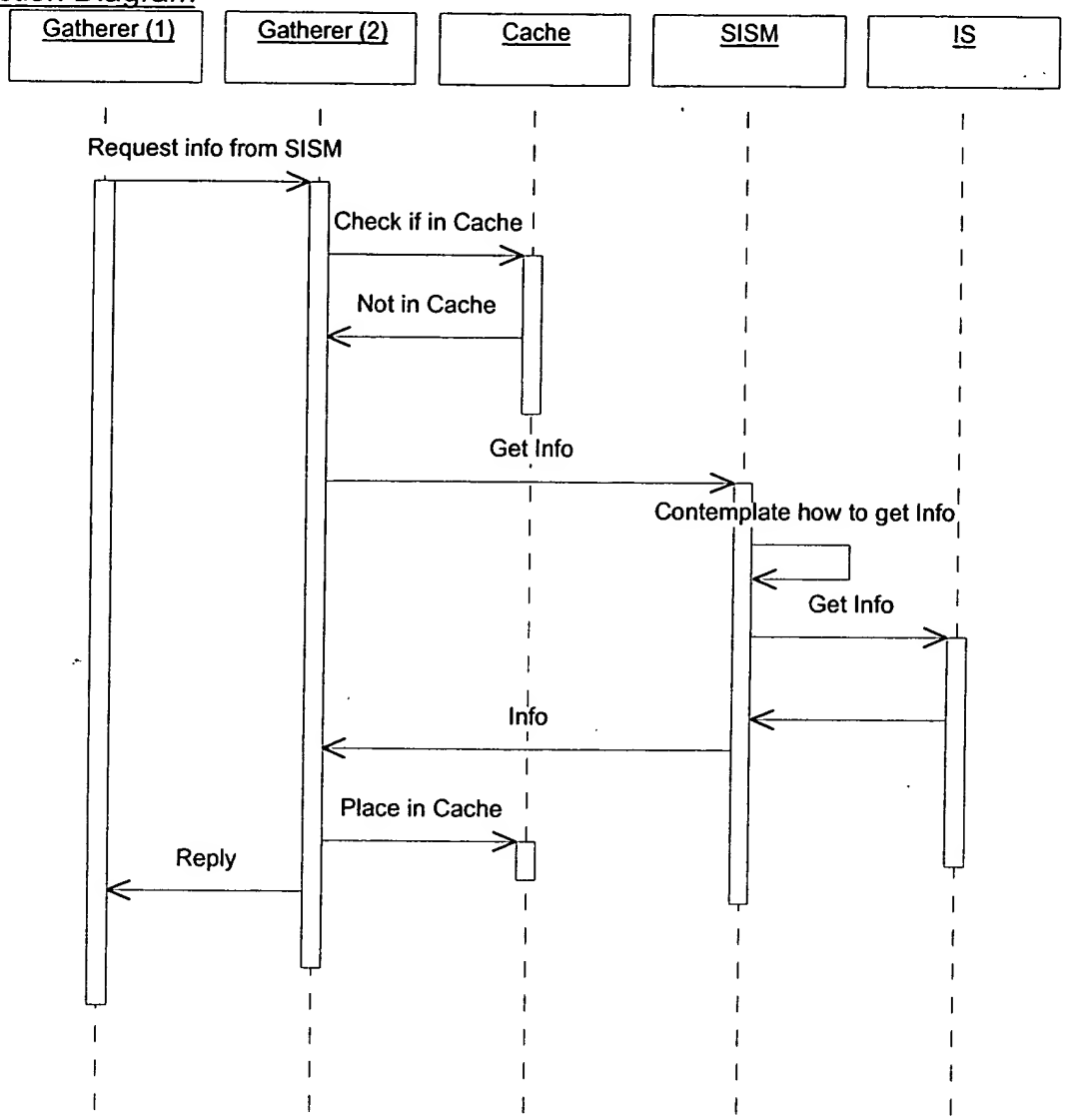
Frequency

High - This happens in every enhancement, but the caching mechanisms should reduce this load.

Alternative Courses

None.

Interaction Diagram



4.8. ROUTE A MESSAGE TO ANOTHER GATHERER

Overview/Purpose

To relay any message to the Gatherer that is the destination of the message.

The Gatherer maintains a fixed route-table controlled by the CEM and downloaded to the Gatherer as part of its configuration. The route table is simply a table identifying to which Gatherer to send a message in order to deliver it to another Gatherer.

Actor/Stimulus

Receipt of message destined to another Gatherer.

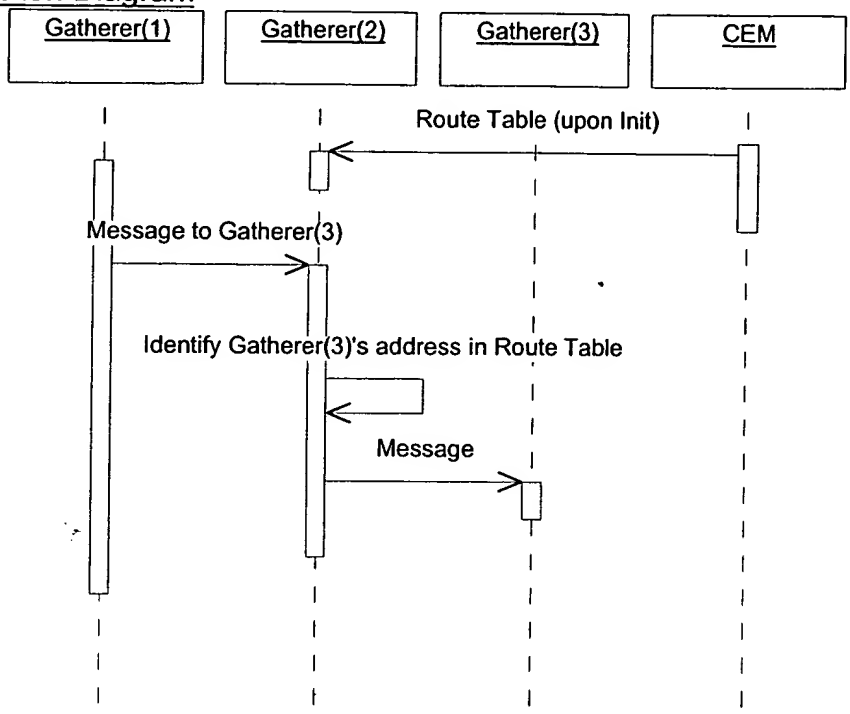
Frequency

High - some traffic may permanently be routed via a Gatherer.

Alternative Courses

None.

Interaction Diagram



4.9. ENHANCE A UNIR RECEIVED FROM ANOTHER GATHERER

Overview/Purpose

To add information to the collected information. The rationale of distributing the enhancement among several Gatherers is:

a. The 1st Gatherer can not efficiently access the enhanced information locally.
b. The 1st Gatherer is not powerful, or is under some other resource constraints that make it inappropriate to process the UNIR further at that site.
c. The UNIR requires several enhancements at the 2nd Gatherer and instead of utilizing the Cache mechanism, it would be better to do all processing at the 2nd Gatherer.
d. The enhancement is of considerable size and the bandwidth of the connection between the 2nd Gatherer and the CEM is larger than that of the bandwidth between the 1st Gatherer and the CEM.
e. This may be computed to conserving total network utilization.
f. Hit ratio of Cache at 1st Gatherer is low, either because the size of the Cache is small or the data is diverse, and therefore the Cache is ineffective.

Actor/Stimulus

UNIR received for enhancement from another Gatherer.

Frequency

Very High - if such enhancements are necessary during the enhancement route of a UNIR, all UNIRs will traverse this link.

Alternative Courses

None.

Interaction Diagram

See "**4.6.** Receive network event from an AISM", the diagram contains this use-case.

4.10. SYNCHRONIZE CLOCKS

See in [3].